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Properties of the Compounds
 RbMnF_3 , KMnF_3 and CsMnF_3

Joan S. Friebely

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INTRODUCTION

This bibliography lists publications related to the double fluorides XMnF_3 , where X is K, Rb or Cs. These materials are antiferromagnetic with Néel temperatures of 88.3°K, 82.6°K and 53.5°K, respectively. Considerable interest has been shown in their properties since about 1960. They are characterized by having large exchange ($H_{\text{ex}} \approx 10^6$ Oe) and small crystalline anisotropy ($H_A < 10$ Oe). Antiferromagnetic resonance (AFMR) can be observed, therefore, at microwave frequencies without the need for very large magnetizing fields. Further, there is a strong hyperfine interaction that causes pronounced coupling between the nuclear magnetic resonance (NMR) of the Mn^{55} nuclei and the AFMR modes. Hence much of the published work to date has dealt with magnetic resonance.

References are listed alphabetically by author. The consecutive numbers beside each citation provide unique identification for the articles as they appear in the subject outline and index.

The sources consulted for the literature search include the abstracting services listed here, lists of references in related published papers, and the scientific journals currently being received by the Lincoln Laboratory Library. We also extend our appreciation to NASA and DDC for their request bibliography services, which were helpful to the comprehensiveness of the survey.

Accepted for the Air Force
Franklin C. Hudson
Chief, Lincoln Laboratory Office

SOURCES CONSULTED

Chemical Abstracts	1957 - July 1968
Dissertation Abstracts	1963 - 1967
Electronics and Communications Abstracts	1961 - August 1966
Physics Abstracts/Science	1957 - July 1968
Solid State Abstracts	1960 - 1965

SUBJECT OUTLINE AND INDEX

Antiferromagnetic Domains

Cole et al. (14); Farztdinov (29); Ince (60); Waring (133).

Antiferromagnetic Resonance (AFMR)

Cole (12); Cole et al. (13, 14); Eastman (22); Eastman et al. (23, 24, 25); Freiser et al. (36, 37); Heeger (44); Heeger et al. (46); Hinderks et al. (51); Ince (60); Kedzie et al. (65, 66); Lee et al. (68); Minkiewicz et al. (80); Ninio et al. (88); Seiden et al. (109); Teaney (124); Teaney et al. (125, 126, 127); Turov et al. (129).

Basic Theory

Blume et al. (8); Bullock (10); DeGennes (19); Farztdinov (29); Freeman et al. (35); Gondaira (39); Gondaira et al. (40); Gorodetsky et al. (41); Hubbard et al. (58); Joseph (64); Lvov et al. (69); Mahler (71); Mehra et al. (75); Ninio et al. (88); Owen et al. (91); Pearson (94); Pincus et al. (99, 100); Prohofsky (104); Rimmer (107); Simanek et al. (113); Suhl (122, 123); Turov et al. (130).

Critical Phenomena

Cooper et al. (17); Golding (38); Teaney et al. (128).

Elasticity-Magnetoelastic Interactions

Collins et al. (15); Denison et al. (20); Eastman (22); Eastman et al. (23); Golding (38); Melcher et al. (77); Pickart et al. (98); Turov et al. (130).

Electron-Nuclear Double Resonance (ENDOR)

Heeger et al. (47, 48, 49); Lee et al. (68); Pincus et al. (99); Portis et al. (103); Shaltiel et al. (110); Witt (138); Witt et al. (139, 140).

Electron Spin Resonance (ESR)

Hall et al. (42); Horai et al. (57); Zhogolev (142).

Hyperfine Interactions

Cooke et al. (16); Egashira et al. (26); Freeman et al. (35); Montgomery et al. (82); Nakamura (85); Shulman et al. (111); Suhl (123); Walker (131).

Impurities

Eastman et al. (25); Holloway et al. (54, 56); Johnson et al. (61); Matyushkin et al. (73); Misetich et al. (81); Perry et al. (95); Pincus et al. (100); Shionoya et al. (112).

Neutron Diffraction

Collins et al. (15); Cooper et al. (17); Johnson et al. (61); Nathans et al. (87); Pickart et al. (97, 98); Satya Murthy et al. (108); Windsor (135, 136); Windsor et al. (137).

Nuclear Magnetic Resonance (NMR)

DeGennes (19); Denison et al. (20); Egashira et al. (26); Freiser et al. (36); Heeger et al. (50); Jones et al. (63); Mahler et al. (72); Minkiewicz (78); Minkiewicz et al. (79, 80); Nakamura (85); Nakamura et al. (86); Ninio et al. (88); Payne et al. (92, 93); Petrov et al. (96); Portis (102); Shulman et al. (111); Teaney (124); Turov et al. (129); Walker (131); Walker et al. (132); Welsh (134).

Optical Studies

Antonov et al. (2); Aoyagi (3); Dietz et al. (21); Elliott et al. (27); Eremenko et al. (28); Ferguson et al. (30, 31, 32, 33); Fleury (34); Holloway et al. (53, 54, 55, 56); Imbusch et al. (59); Johnson et al. (62); Kharchenko et al. (67); Matyushkin et al. (73); Mehra et al. (75, 76); Misetich et al. (81); Perry et al. (95); Prohofsky (104); Prohofsky et al. (105); Shionoya et al. (112); Stevenson (115, 116, 117, 119, 120); Young et al. (141).

Physical Properties

Aleksandrov et al. (1); Beckman et al. (4, 5); Belyaev et al. (6, 7); Breed (9); Chang (11); Collins et al. (15); Cooke et al. (16); Cooper et al. (17); Deenades et al. (18); Gorodetsky (41); Hashimoto (43); Heeger et al. (45); Hirakawa et al. (52); Joseph (64); Kedzie et al. (66); Lee et al. (68); Machin et al. (70); McGuire (74); Montgomery et al. (82); Moruzzi et al. (83, 84); Ogawa (89); Okazaki et al. (90); Pearson (94); Pickart et al. (97); Prohovsky et al. (105); Rao et al. (106); Simanov et al. (114); Stevenson et al. (118); Suemune et al. (121); Teaney (124).

Relaxation

Blume et al. (8); Heeger et al. (48); Hinderks et al. (51); Mahler (71); Mahler et al. (72); Portis (101); Suhl (123).

Spin Waves

Cole (12); Cole et al. (13); Freiser et al. (36); Heeger (44); Heeger et al. (46); Hinderks et al. (51); Nathans et al. (87); Ninio et al. (88); Windsor et al. (137).

PROPERTIES OF THE COMPOUNDS RbMnF_3 , KMnF_3 AND CsMnF_3

1. Aleksandrov, K. S., Reshchikova, L. M. and Beznosikov, B. V.
Behaviour of the Elastic Constants of KMnF_3 Single Crystals near the Transition of Puckering
 Phys Stat Sol, Vol 18, No 1, pp K17-K20 (1 Nov 1966).
 The velocities of longitudinal and shear elastic waves along principal crystalline directions were measured by an ultrasonic pulse method at a frequency of 30 MHz.

2. Antonov, A. V., Belyaeva, A. I. and Eremenko, V. V.
Low-Temperature Anomaly in the Absorption Spectra of the Antiferromagnets RbMnF_3 and KMnF_3
 Fiz Tverd Tela, Vol 8, No 11, pp 3397-3399 (Nov 1966); Engl. transl. in Soviet Phys-Solid State, Vol 8, No 11, pp 2718-2720 (May 1967).
 A discontinuity was found in the absorption of the $C_1(^6A_{1g} \rightarrow ^9E_g)$ and C_4 bands ($\sim 3900 \text{ \AA}$) at temperatures below 30°K .

3. Aoyagi, K.
Observation of Magnon Sideband in the Absorption Spectrum of KMnF_3
 J Phys Soc Japan, Vol 22, No 6, pp 1516-1517 (Jun 1967).
 The absorption lines B ($17,892 \text{ cm}^{-1}$) and C ($17,811 \text{ cm}^{-1}$) are attributed to pure electronic transitions (main lines) corresponding to the transition $^6A_{1g} \rightarrow ^4T_{1g}$ of Mn^{2+} , while the A ($17,944 \text{ cm}^{-1}$) line is attributed to the magnon sideband of C.

4. Beckman, O. and Knox, K.
Magnetic Properties of KMnF_3 . I. Crystallographic Studies
 Phys Rev, Vol 121, No 2, pp 376-380 (15 Jan 1961).
 Measurements of the lattice parameters for KMnF_3 by means of an x-ray rotation camera designed for temperatures down to 15°K are reported.

5. Beckman, O., Olovsson, I. and Knox, K.
Structural Changes of KMnF_3 at Low Temperatures
 Acta Cryst, Vol 13, Pt 6, p 506 (10 Jun 1960).
 Using x-ray analysis, the crystal structure of KMnF_3 was examined when the material was cooled through the Néel temperature.

6. Belyaev, I. N. and Revina, O. Ya.
The MF- MnF_2 Systems (M = Li, Na, K, Rb, Cs)
 Zhur Neorgan Khim, Vol 11, No 6, pp 1446-1450 (1966); Engl. transl. in Russian J Inorgan Chem, Vol 11, No 6, pp 772-774 (Jun 1966).
 The compositions of binary systems of the alkali metal fluorides were studied by thermography.

7. Belyaev, I. N. and Revina, O. Ya.
Ternary Systems of the Manganese and Alkali Metal Fluorides
 Zhur Neorgan Khim, Vol 11, No 8, pp 1952-1958 (1966); Engl. transl. in Russian J Inorgan Chem, Vol 11, No 8, pp 1041-1044 (Aug 1966).
 Systems studied include LiF-CsF-MnF_2 , NaF-CsF-MnF_2 , KF-CsF_2 , CsF-KF , $\text{NaMnF}_3\text{-CsMnF}_3$, and $\text{CsMnF}_3\text{-KMnF}_3$.

8. Blume, M. and Orbach, H.

Spin-Lattice Relaxation of S-State Ions: Mn^{2+} in a Cubic Environment
Phys Rev, Vol 127, No 5, pp 1587-1592 (1 Sep 1962)

The theory of spin-lattice relaxation is developed for S-state ions; in particular, for Mn^{2+} in a cubic environment. The wave functions for Mn^{2+} are generated to 1st order in the spin-orbit coupling parameter, the orbit-lattice interaction is formulated in terms of spherical harmonics, and the rate equations are derived for this system.

9. Breed, D. J.

Experimental Investigation of Two Two-Dimensional Antiferromagnets with Small Anisotropy
Physica, Vol 37, No 1, pp 35-46 (1967).

The magnetic properties have been studied of two antiferromagnetic Mn compounds, K_2MnF_4 and Rb_2MnF_4 .

10. Bullock, D. L.

Perturbation Treatment of the Antiferromagnetic Ground State
Phys Rev, Vol 137, No 6A, pp 1877-1885 (15 Mar 1965).

Ground-state parameter series expansions are generated for the Heisenberg model. Experimental results for $KMnF_3$ and MnF_2 are not contradicted by this perturbation treatment.

11. Chang, T.-S.

Dielectric Properties of $RbMnF_3$
J Appl Phys, Vol 39, No 7, pp 3511-3512 (Jun 1967).

The dielectric constant and loss tangent of $RbMnF_3$ were measured as functions of frequency in the temperature range 25°C to 300°C.

12. Cole, P. H.

Nonlinear Coupling between Antiferromagnetic Resonance Modes in $RbMnF_3$
Appl Phys Lett, Vol 10, No 10, pp 272-275 (15 May 1967).

Nonlinear coupling between AFMR modes spaced in frequency an octave apart has been demonstrated experimentally. Calculations of the power-dependent conversion relation for up-conversion, and the critical power for subharmonic oscillation are given.

13. Cole, P. H. and Courtney, W. E.

Uniform Mode Resonance and Spin-Wave Instability in $RbMnF_3$
Proc 12th Ann Conf Magnetism and Magnetic Materials, Washington, D. C., 1966, ed. by E. G. Spencer and J. S. Kouvel; J Appl Phys, Vol 38, No 3, pp 1278-1279 (1 Mar 1967).

Low-power resonance linewidth and high-power 2nd-order spin-wave instability measurements were performed at 4.2°K.

14. Cole, P. H. and Ince, W. J.

Equilibrium Spin Configuration and Resonance Behavior of $RbMnF_3$
Phys Rev, Vol 150, No 2, pp 377-383 (14 Oct 1966).

Observations of the resonance spectrum at X-band frequencies for the applied field range 0 to 12 kOe are presented.

15. Collins, M. F. and Nathans, R.
Some Measurements of Exchange Energies by Paramagnetic Neutron Inelastic Scattering
Proc 10th Conf Magnetism and Magnetic Materials, Minneapolis, Minn., 1964, ed. by I. S. Jacobs and E. G. Spencer; J Appl Phys, Vol 36, No 3, Pt 2, pp 1092-1093 (Mar 1965).

Neutron paramagnetic scattering techniques have been applied to the measurement of exchange constants for a series of perovskite salts, KMnF_3 , NaMnF_3 , LaCrO_3 , LaMnO_3 , and LaFeO_3 .
16. Cooke, A. H. and Edmonds, D. T.
Nuclear Magnetic Interaction in an Antiferromagnetic Crystal
Proc Phys Soc, Vol 71, Pt 3, pp 517-519 (Jun 1958).

The measurement of the specific heat anomaly at the Néel temperature gave a value for the hyperfine coupling constant in MnF_2 in good agreement with previous determinations by other methods.
17. Cooper, M. J. and Nathans, R.
Critical Magnetic Scattering from KMnF_3
Proc 11th Ann Conf Magnetism and Magnetic Materials, San Francisco, Calif., 1965, ed. by E. G. Spencer and J. S. Kouvel; J Appl Phys, Vol 37, No 3, pp 1041-1047 (1 Mar 1966).

Magnetic scattering experiments on KMnF_3 are described.
18. Deenadas, D., Keer, H. V., Gopala Rao, R. V. and Biswas, A. B.
Heat Capacity of Potassium Manganese Trifluoride
British J Appl Phys, Vol 17, No 11, pp 1401-1404 (Nov 1966).

The heat capacity of KMnF_3 has been measured in the temperature range 80°K to 300°K.
19. DeGennes, P. G.
Dynamic Effects in the Nuclear Resonance of Magnetic Materials (in French)
"Magentic and Electric Resonance and Relaxation," Proc 11th Colloq AMPERE (Atomes Mol. Études Radio Elec.), Eindhoven, 1962, ed. by J. Smidt, North-Holland Publ. Co., Amsterdam, pp 88-95 (1963).

The nuclear spin-wave spectrum produced by the Suh-Nakamura indirect interaction is discussed.
20. Denison, A. B., James, L. W., Currin, J. D., Tanttila, W. H. and Mahler, R. J.
Ultrasonically Induced Nuclear Spin Transitions in Antiferromagnetic KMnF_3
Phys Rev Lett, Vol 12, No 10, pp 244-245 (9 Mar 1964).

A technique for producing nuclear spin transitions of F^{19} nuclei in KMnF_3 single crystals via ultrasonic modulation is described.
21. Dietz, R. E., Johnson, L. F. and Guggenheim, H. J.
Fluorescence from Magnetic Crystals
"Physics of Quantum Electronics, Conference Proceedings," ed. by P. L. Kelley, B. Lax and P. E. Tannenwald, McGraw-Hill Book Co., New York, N. Y., pp 361-369 (1966).

Near-infrared fluorescence and absorption have been investigated for Ni in KMnF_3 .
22. Eastman, D. E.
Magneto-Elastic Coupling in RbMnF_3
Phys Rev, Vol 156, No 2, pp 645-654 (10 Apr 1967).

Magnetoelastic coupling effects have been studied by observing shifts in AFMR frequency and changes in AFMR line shape with the application of axial stress.

23. Eastman, D. E., Joenk, R. J. and Teaney, D. T.
Antiferromagnetic Resonance in RbMnF_3 under Axial Stress
 Phys Rev Lett, Vol 17, No 6, pp 300-302 (8 Aug 1966).
 Magnetoelastic constants of antiferromagnetic RbMnF_3 were determined at 4.2°K.
24. Eastman, D. E. and Shafer, M. W.
Antiferromagnetic Resonance in Cubic TlMnF_3
 J Appl Phys, Vol 38, No 3, pp 1274-1276 (1 Mar 1967).
 Antiferromagnetic resonance studies at 25 GHz showed TlMnF_3 to be an undistorted cubic antiferromagnet at 4.2°K with $\langle 111 \rangle$ easy axes.
25. Eastman, D. E., Shafer, M. W. and Figat, R. A.
Cobalt-Doped TlMnF_3 , a Zero Anisotropy Cubic Antiferromagnet
 J Appl Phys, Vol 38, No 13, pp 5209-5211 (Dec 1967).
 Single crystals of cobalt-doped thallium manganese fluoride ($\text{TlMn}_{1-x}\text{Co}_x\text{F}_3$) have been studied by AFMR for cobalt concentrations of $0 \leq x \leq 0.001$. Comparison with AFMR of undoped TlMnF_3 and RbMnF_3 is made.
26. Egashira, K. and Hirakawa, K.
Observation of the Hyperfine Interaction Constants in KMnF_3
 J Phys Soc Japan, Vol 22, No 1, p 344 (Jan 1967).
 The hyperfine constant is obtained from NMR experiments on the F^{19} nucleus.
27. Elliott, R. J., Thorpe, M. F., Imbusch, G. F., Loudon, R. and Parkinson, J. B.
Magnon-Magnon and Exciton-Magnon Interaction Effects on Antiferromagnetic Spectra
 Phys Rev Lett, Vol 21, No 3, pp 147-150 (15 Jul 1968).
 Green's function methods have been used to calculate the effect of magnon-magnon and exciton-magnon interactions on the sidebands in RbMnF_3 .
28. Eremenko, V. V., Popkov, Yu. A., Novikov, V. P. and Belyaeva, A. I.
Characteristics of Exciton-Magnon Interaction in Antiferromagnetic Crystals with a Perovskite Structure
 Zhur Eksper Teor Fiz, Vol 52, No 2, pp 454-462 (Feb 1967); Engl. transl. in Soviet Phys - JETP, Vol 25, No 2, pp 297-302 (Jul 1967).
 The optical absorption spectra of RbMnF_3 and KMnF_3 are studied in the ${}^6\text{A}_{1g}({}^6\text{S}) \rightarrow {}^4\text{E}_g({}^4\text{G})$ transition range in the Mn^{2+} ion.
29. Farztdinov, M. M.
Domains and S-Domain Boundaries in Antiferromagnetic Compounds
 Fiz Metal Metalloved, Vol 19, No 3, pp 321-332 (1965); Engl. transl. in Phys Met Metallog, Vol 19, No 3, pp 1-12 (1965).
 The possible domains and S-domain boundaries were investigated in antiferromagnetic compounds of the NiO type, and also uniaxial (Cr_2O_3 , MnF_2) and orthorhombic ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$).
30. Ferguson, J., Guggenheim, H. J. and Tanabe, Y.
Absorption of Light by Pairs of Exchange-Coupled Manganese and Nickel Ions in Cubic Perovskite Fluorides
 J Chem Phys, Vol 45, No 4, pp 1134-1142 (15 Aug 1966).
 The absorption of light by exchange-coupled pairs of Mn and Ni ions in KZnF_3 is reported. Corresponding effects of exchange interaction have also been observed in the spectra of $\text{KMn}_x\text{Ni}_{1-x}\text{F}_3$ crystals.

31. Ferguson, J., Guggenheim, H. J. and Tanabe, Y.
Absorption of Light by Pairs of Like and Unlike Transition-Metal Ions
 Phys Rev Lett, Vol 14, No 18, pp 737-738 (3 May 1965).
 Absorption of light by pairs of like and unlike transition-metal ions is described. Absorption by pairs of unlike ions is possible, and in all cases studied, the intensity of absorption is greater than for like ion pairs.

32. Ferguson, J., Guggenheim, H. J. and Tanabe, Y.
The Effects of Exchange Interactions in the Spectra of Octahedral Manganese. II. Compounds
 J Phys Soc Japan, Vol 21, No 4, pp 692-704 (Apr 1966).
 Experimental measurements of the Mn-pair spectrum of $\text{KZnF}_3\text{:Mn}$ and the spectrum of KMnF_3 are reported.

33. Ferguson, J., Guggenheim, H. J. and Tanabe, Y.
Exchange Effects in the Electronic Absorption Spectrum of Mn (II) in Perovskite Fluorides
 Proc 10th Conf Magnetism and Magnetic Materials, Minneapolis, Minn., 1964, ed. by I. S. Jacobs and E. G. Spencer; J Appl Phys, Vol 36, No 3, Pt 2, pp 1046-1047 (Mar 1965).
 The anomalously intense bands in the spectrum of KMnF_3 are interpreted on the basis of pure electronic transitions involving more than one ion.

34. Fleury, P. A.
Evidence for Magnon-Magnon Interactions in RbMnF_3
 Phys Rev Lett, Vol 21, No 3, pp 151-153 (15 Jul 1968).
 Light scattering from two-magnon excitations in RbMnF_3 has been detected. The experiments confirm the importance of magnon-magnon interactions.

35. Freeman, A. J. and Watson, R. E.
Origin of the F^{19} Hyperfine Structure in Transition Element Fluorides
 Phys Rev Lett, Vol 6, No 7, pp 343-345 (1 Apr 1961).
 The unpairing of the 1s electrons gives an appreciable contribution to the isotropic part of the hyperfine structure. This is illustrated with use of KMnF_3 as an example.

36. Freiser, M. J., Joenk, R. J., Seiden, P. E. and Teaney, D. T.
Magnetic Resonance Studies of the Cubic Antiferromagnet RbMnF_3
 Proc Int Conf Magnetism, Nottingham, 1964, publ. by Institute of Physics and the Physical Society, London, pp 432-436 (1965).
 The properties of the cubic antiferromagnet RbMnF_3 were studied by AFMR and Mn^{55} NMR.

37. Freiser, M. J., Seiden, P. E. and Teaney, D. T.
Field-Independent Longitudinal Antiferromagnetic Resonance
 Phys Rev Lett, Vol 10, No 7, pp 293-294 (1 Apr 1963).
 The field-independent AFMR mode for the flopped state was studied as a function of frequency and temperature.

38. Golding, B.
Ultrasonic Propagation in RbMnF_3 near the Magnetic Critical Point
 Phys Rev Lett, Vol 20, No 1, pp 5-7 (1 Jan 1968).
 Measurements of the ultrasonic attenuation and velocity near the magnetic critical point have been performed at UHF frequencies.

39. Gondaira, K.
Covalency Effects in KMnF_3
 J Phys Soc Japan, Vol 21, No 5, pp 933-944 (May 1966).
 The covalency parameters between Mn 3d orbitals and the neighboring F 2s, 2p orbitals in KMnF_3 are calculated by means of the molecular orbital method.

40. Gondaira, K. and Tanabe, Y.
A Note on the Theory of Superexchange Interaction
 J Phys Soc Japan, Vol 21, No 8, pp 1527-1548 (Aug 1966).
 Expressions are derived for the coupling constant in the interaction between a paramagnetic ion pair and an electric field. KMnF_3 is used as an example.

41. Gorodetsky, G.
Semiempirical Expression for the Paramagnetic Susceptibility of LuFeO_3 and KMnF_3 by the Padé Approximant
 Solid State Commun, Vol 6, No 3, pp 159-162 (Mar 1968).
 The theoretical susceptibility, based on the use of a Padé approximation, gives better fit to the experimental data in the region $(T/T_C) < 2$ than the expression obtained by using a high-temperature series expansion.

42. Hall, T. P. P., Hayes, W. and Williams, F. I. B.
Paramagnetic Resonance of Manganese
 Proc Phys Soc, Vol 78, Pt 5, pp 883-894 (Nov 1961).
 The paramagnetic resonance spectrum of bivalent Mn was studied in the crystals CdF_2 , KMgF_3 , and CdTe . Comparison is drawn with the spectrum of KMnF_3 .

43. Hashimoto, T.
Magnetic Properties of the Solid Solutions between KMnF_3 , KCoF_3 , and KNiF_3
 J Phys Soc Japan, Vol 18, No 8, pp 1140-1147 (Aug 1963).
 The magnetic susceptibilities of KNiF_3 and the solid solutions between KMnF_3 , KCoF_3 , and KNiF_3 have been measured in the temperature range between 80°K and 850°K.

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Spin-Wave Instability and Premature Saturation in Antiferromagnetic Resonance
 Phys Rev, Vol 131, No 2, pp 608-616 (15 Jul 1963).
 Experimental evidence for the existence of spin-wave instability in the canted antiferromagnet KMnF_3 is presented and discussed.

45. Heeger, A. J., Beckman, O. and Portis, A. M.
Magnetic Properties of KMnF_3 . II. Weak Ferromagnetism
 Phys Rev, Vol 123, No 5, pp 1652-1660 (1 Sep 1961).
 The static magnetic properties of single-crystal KMnF_3 were studied by magnetic torsion measurements.

46. Heeger, A. J. and Pincus, P.
Spin-Wave Instability and Premature Saturation in Antiferromagnetic Resonance
 Phys Rev Lett, Vol 10, No 2, pp 53-55 (15 Jan 1963).
 Premature saturation and spin-wave instability were observed in KMnF_3 .

47. Heeger, A. J., Portis, A. M., Teaney, D. T. and Witt, G.
Double Resonance and Nuclear Cooling in an Antiferromagnet
 Phys Rev Lett, Vol 7, No 8, pp 307-309 (15 Oct 1961).
 Electron-nuclear double resonance was observed in KMnF_3 .
 Measurements of the saturation decay yielded a value of
 50 msec for T_1 .
48. Heeger, A. J., Portis, A. M. and Witt, G.
Relaxation of Mn^{55} Nuclear Magnetization in Antiferromagnetic KMnF_3
 Bull Amer Phys Soc, Ser 2, Vol 7, No 1, p 54 (24 Jan 1962).
 Observations of the nuclear resonance of Mn^{55} in antiferromagnetic
 KMnF_3 by the double resonance technique are discussed.
49. Heeger, A. J., Portis, A. M. and Witt, G.
Nuclear Antiferromagnetic Double Resonance
 "Magnetic and Electric Resonance and Relaxation," Proc 11th Colloq AMPERE
 (Atomes Mol. Études Radio Elec.), Eindhoven, 1962, ed. by J. Smidt, North-
 Holland Publ. Co., Amsterdam, pp 694-698 (1963).
 This technique was applied to demonstrate the dependence of the
 Mn^{55} nuclear resonance frequency in KMnF_3 on nuclear magnetization.
50. Heeger, A. J. and Teaney, D. T.
 Mn^{55} Nuclear Magnetic Resonance in Antiferromagnetic RbMnF_3
 Proc 9th Conf Magnetism and Magnetic Materials, Atlantic City, N. J.,
 1963, ed. by J. A. Osborn; J Appl Phys, Vol 35, No 3, Pt 2, pp 846-847
 (Mar 1964).
 The observation and study of the Mn^{55} NMR in antiferromagnetic
 RbMnF_3 at low temperatures are reported.
51. Hinderks, L. W. and Richards, P. M.
Excitation of Nuclear and Electronic Spin Waves in RbMnF_3 by Parallel Pumping
 J Appl Phys, Vol 39, No 2, Pt 1, pp 824-825 (1 Feb 1968).
 Observation of the simultaneous excitation of nuclear and electronic
 spin waves by parallel pumping is reported. From threshold fields,
 which are about 1.2 Oe minimum, it is calculated that at 4.2°K,
 $\eta K^n \eta K^e = 6.1 \times 10^{10} \text{ sec}^{-2}$ for $K \rightarrow 0$, and $9.5 \times 10^{10} \text{ sec}^{-2}$ for
 $K = 1.05 \times 10^5 \text{ cm}^{-1}$.
52. Hirakawa, K., Hirakawa, K. and Hashimoto, T.
Magnetic Properties of Potassium Iron Group Fluorides KMF_3
 J Phys Soc Japan, Vol 15, No 11, pp 2063-2068 (Nov 1960).
 The susceptibility of KMnF_3 , in particular, was measured as a
 function of temperature.
53. Holloway, W. W., Jr. and Kestigian, M.
Effect of Magnetic Ordering on the Fluorescence of MnF_2
 Phys Rev Lett, Vol 13, No 7, pp 235-237 (17 Aug 1964).
 Measurements were made of the wavelength, the relative intensity,
 and the lifetime of fluorescence in RbMnF_3 , CsMnF_3 , etc.
54. Holloway, W. W., Jr. and Kestigian, M.
Temperature Dependence of the $^3A_2 \rightarrow ^3T_1$ Absorption Band Peak of the Ni^{2+}
 Ion in Nickel and Manganese Salts
 Phys Rev Lett, Vol 15, No 1, pp 17-19 (5 Jul 1965).
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The chemical shifts of Tl^{203} , Tl^{205} , and F^{19} in TlMnF_3 have been calculated.

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13. ABSTRACT This bibliography lists and briefly annotates publications related to the double fluorides XMnF ₃ , where X is K, Rb or Cs. References are listed alphabetically by author, and there is a subject outline and index. The period covered by the search is 1957 to July 1968.		
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